GTL Working Group Analysis

California Energy Commission

Sacramento, CA

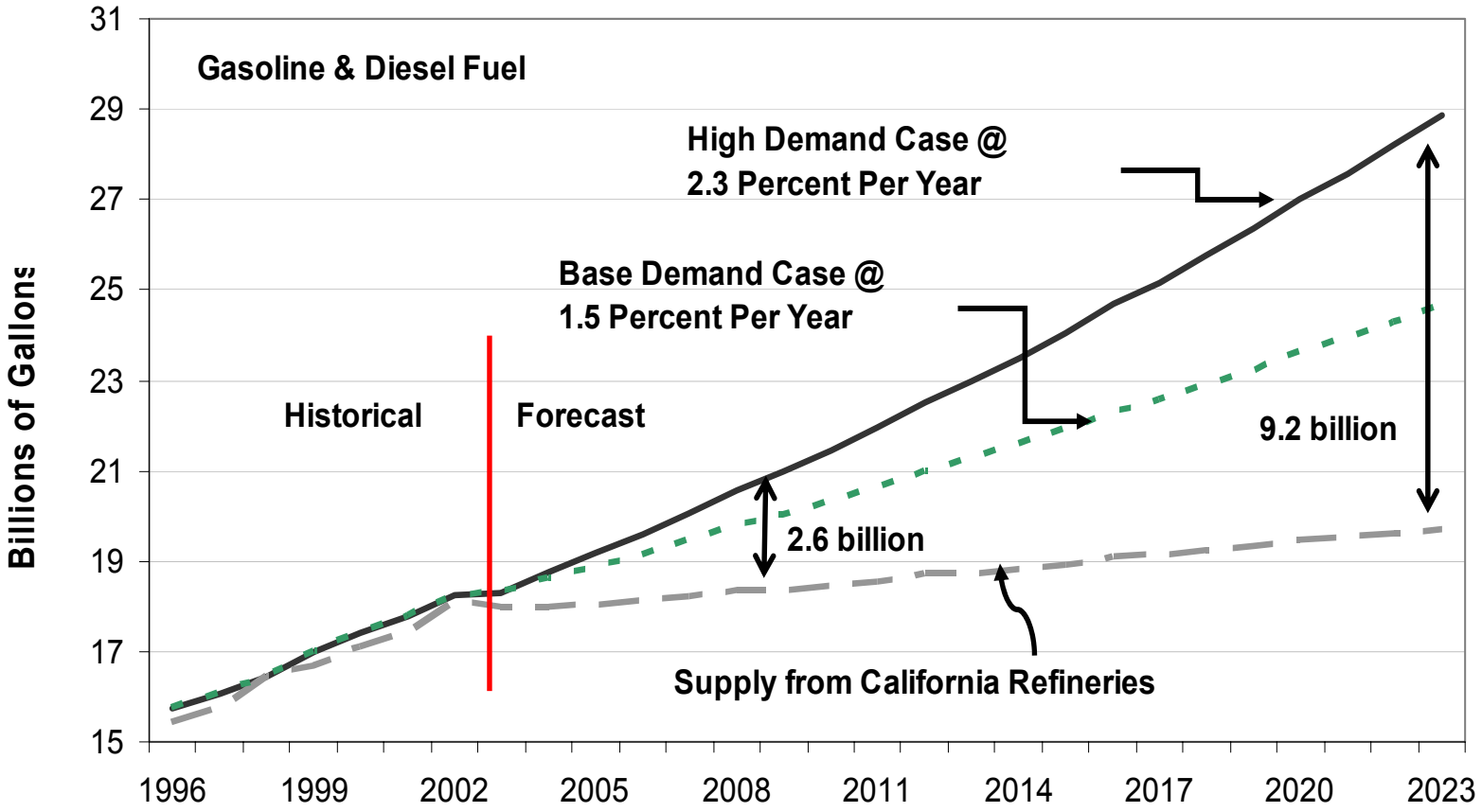
October 12, 2004

GTL Working Group Members

22 Total Members

- 10 - Energy Companies (BP, ChevronTexaco, ConocoPhillips, Paramount, Shell & Texaco)
- 6 - Agencies (ARB, CEC, Caltrans, Diesel Tech Forum, NREL, SCAQMD)
- 6 – Others (ANGTL, Nexant, Syntroleum, World GTL & WSPA)

California Demand versus Local Supply



Source: CEC, Investigating the Causes of California's Petroleum Infrastructure Development Constraints June 28, 2004

Prerequisites for GTL Penetration

- Adequate GTL Supply
- Adequate GTL Demand
- Consumer Acceptance
- Adequate Market
- Competitive Economics

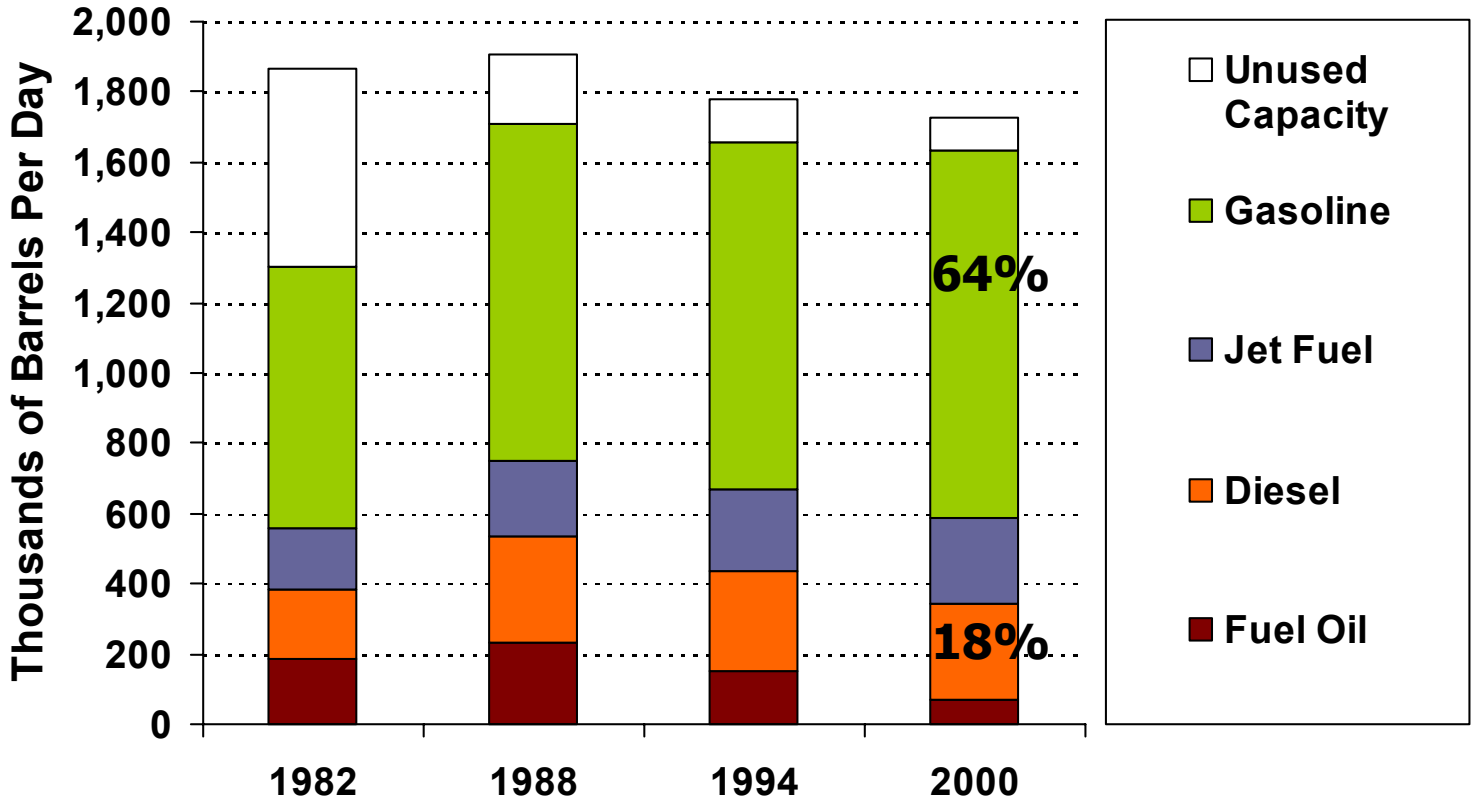
GTL Supply Analysis

Company	Location	Plant Capacity (bbl/ op day)	Diesel Production	Operation Date	Probability of Operation	Prob.-Weighted Diesel
Existing Plants						
Shell	Malaysia	12,500	2,000	1993		
Sasol I-III	South Africa	175,000	Coal-fed, high-T	1955-1982	None exported.	
Sasol	Sasolburg	2,500	1,800	1993	None exported.	
PetroSA	South Africa	22,500	5,000	1991	None exported.	
						Estimated 2010 Capacity is 74,5900 BBL/D
Under Construction or EPC						
Sasol - ORYX-I	Qatar	34,000	24,000	2005	98%	23,520
Shell	Malaysia	2,200	1,500	2005	98%	1,470
SasolChevron	Nigeria	34,000	24,000	2008	90%	21,600
In Design (FEED)/Delineation of Reserves						
Shell 1st Phase	Qatar	70,000	35,000	2009	80%	28,000
Shell 2nd Phase	Qatar	70,000	35,000	2011	80%	28,000
ExxonMobil	Qatar	166,000	83,000	2011	70%	58,100
ConocoPhillips	Qatar	80,000	60,000	2009	70%	42,000
ConocoPhillips	Qatar	80,000	60,000	2011?	60%	36,000
Under Discussion/Feasibility Studies						
SasolChevron - ORYX-II	Qatar	66,000	52,000	2009	70%	36,400
SasolChevron - IQGTL	Qatar	130,000	98,000	2010	70%	68,600
						Estimated 2015 Capacity
Pre-Feasibility or Conceptual Stage						
Marathon	Qatar	140,000	105,000	???	20%	21,000
Ivanhoe	Qatar	185,000	138,000	???	10%	13,800
Sasol Chevron	Australia	45,000	34,000	2012?	30%	10,200
	Total	**1,102,200**	**749,500**	Average:	**52%**	**388,690**

GTL Supply Potential

Working Group Estimated GTL Capacity		
Year	(bbl/d)	(gallon/year)
2010	75,000	1,150,000,000
2015	388,700	5,960,000,000
2020	800,000	12,265,000,000

California Refinery Capacity



Gasoline and Diesel Demand is lopsided

Working Hypothesis and Question

Introducing large volumes of GTL today is counter-productive to refinery balance.

California's demand is heavily concentrated on gasoline rather than diesel

- Diesel demand represents 18% of California petroleum demand
- Gasoline represents 64% of petroleum demand

Q. How do you reduce gasoline and grow diesel demand simultaneously, so the market can accommodate large volumes of GTL?

A. Light Duty Diesel Vehicles – Dieselization

Base Scenario Assumptions

By 2010, hybrid vehicles are preferred over diesel in the United States

- Light duty diesels (LDDs) meet emission standards, but are unable to make any significant market impression.

By 2015, LDDs have become a small niche in the total fleet.

- Imports of GTL, when they occur, are sporadic i.e. may be used for a refinery turnaround.
- GTL is minimally used (0-5%) as an emission reduction fleet strategy.
- Markets in Europe, Australia, and Japan consume the majority of the world's GTL production.

By 2020, diesel demand has significantly grown and there is an incremental opportunity for GTL imports to help refiners meet total transportation demand. GTL penetration grows slowly to 10 percent of on-road diesel demand.

EIA Analysis

- **Energy and Economic Implications of a 30 percent Light Duty Diesel Penetration in the USA** [1]
- The Energy Information Administration modeled the impacts of increased demand for diesel fuel stemming from an (hypothetical) increase in the penetration of light duty diesel-fueled vehicles. New light duty diesel vehicle sales of 10, 20, and 30 percent by 2020 were evaluated. Rebound effects that offset fuel economy gains were considered.

- **Concluded that a 30 Percent Light Duty Diesel Penetration in the USA would result in the following:**

- **22% Reduced Gasoline Demand**
- **52% Increased Diesel Demand**

- [1] Service Report, *The Increased Diesel Penetration in the Transportation Sector*, Office of Integrated Analysis and Forecasting, Energy Information Administration, U.S. Department of Energy, August 1998. http://www.eia.doe.gov/oiaf/servicerpt/intro.html

Aggressive Scenario

By 2010, No Change in Demand from the Base Case

- Small niche market - GTL use as a Fleet emission control strategy
- By 2007 LDDs comply with NOx standards and hit the ground running.

By 2015, the move toward dieselization has taken off.

- 30 percent of new vehicles sold are diesel vehicles.
- Refiners reconfigure production to meet growing diesel demand as gasoline demand is flat - GTL imports are used to help refiners meet growing diesel demand.
- Premium diesel fuels (may contain GTL), are sold catering to the new light diesel market.
- GTL market penetration is 10% of on-road diesel demand.

By 2020, refiners in California are clearly stretched to meet diesel and gasoline demand and GTL imports supply a full one-third of the expanded diesel market.

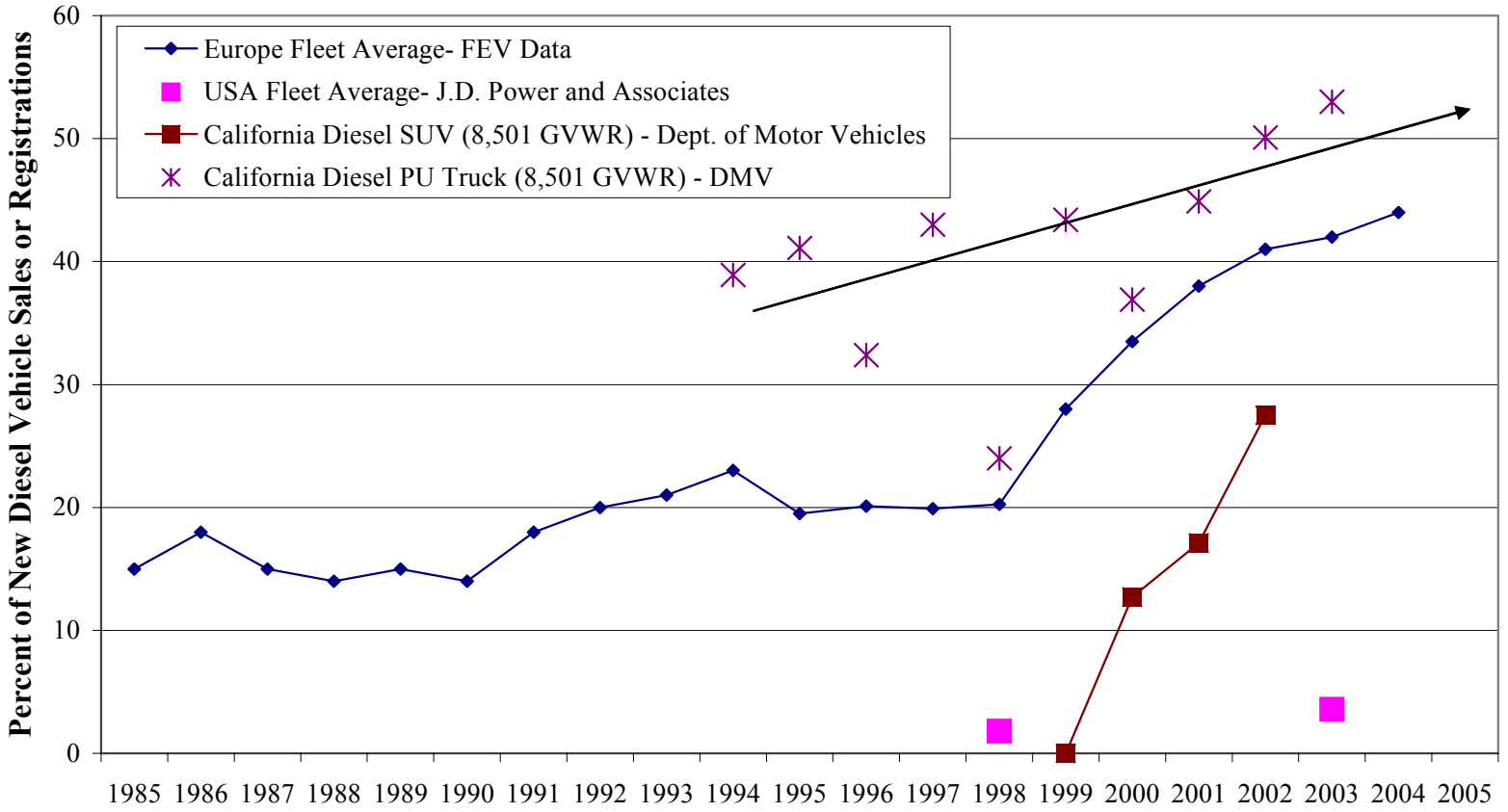
Assumed Affects of a 30% LDD Penetration on Fuel Demand in CA

Base Case Demand				Aggressive Case Change in Demand		Aggressive Case Demand		
Year	Gasoline Demand	Diesel Demand	**Total**	Reduced Gasoline Demand	Increased Diesel Demand	Gasoline Demand	Diesel Demand	**Total**
	(million gallons/year)					**(million gallons/year)**		
2010	17,139	3,579	**20,718**	0%	0%	17,139	3,579	**20,718**
2015	18,204	3,875	**22,079**	10.8%	25.9%	16,238	4,878	**21,117**
2020	19,519	4,173	**23,692**	21.7%	51.8%	15,283	6,335	**21,618**

Source: Service Report, *The Impacts of Increased Diesel Penetration in the Transportation Sector*, Office of Integrated Analysis and Forecasting, Energy Information Administration, U.S. Department of Energy, August 1998.

Analysis of LDD Markets

Fig. 1. Light Duty Diesel Penetration Trends in Europe, California and USA



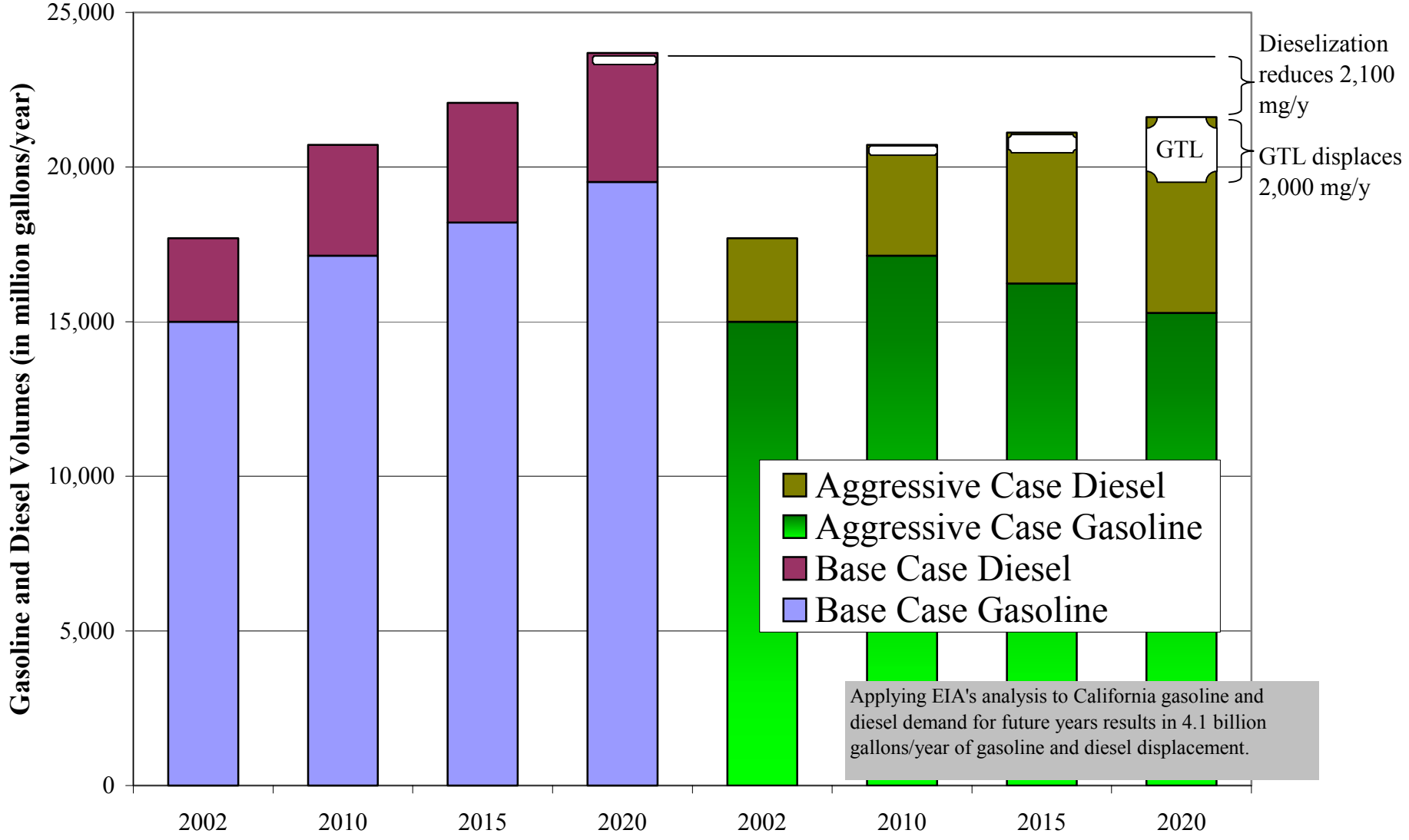
Source: (California Data) October 2003/April 2004 Operational Counts, The Energy Commission's DMV Data Project.)

Example of LDD Penetration Sufficient to Generate the Needed Increased Diesel Demand

	New Vehicles Registered in California	Miles / Gallon	Annual Miles / Vehicle	1st Year % of New Vehicle Sales	2nd Year % of New Vehicle Sales	3rd Year % of New Vehicle Sales	4th Year % of New Vehicle Sales	5th Year % of New Vehicle Sales
CAR-MINI	20,433	35	14,000	0%	0%	1%	3%	3%
CAR-SUBCOMPACT	232,303	35	14,000	1%	3%	5%	8%	10%
CAR-COMPACT	266,166	35	14,000	1%	3%	5%	8%	10%
CAR-MIDSIZE	264,936	28	14,000	1%	5%	8%	10%	12%
CAR-LARGE	74,677	28	14,000	1%	5%	10%	15%	20%
CAR-SPORT	82,917	20	14,000	0%	0%	0%	0%	0%
PICKUP-COMPACT	93,703	25	14,000	3%	8%	12%	15%	30%
PICKUP-STD	132,757	18	14,000	10%	15%	25%	30%	35%
PICKUP 8,501-10,000	26,509	15	18,000	5%	5%	5%	5%	5%
VAN-COMPACT	127,720	15	14,000	10%	15%	25%	30%	30%
VAN-STD	21,141	20	14,000	10%	15%	25%	30%	30%
VAN 8,501-10,000	7,253	15	18,000	1%	1%	1%	1%	1%
SPT/UT-COMPACT	211,726	25	14,000	0%	10%	15%	25%	30%
SPT/UT-STD	93,507	20	14,000	5%	15%	25%	35%	35%
SPT/UT-MINI	11,041	30	14,000	0%	0%	3%	5%	15%

2001 DMV Data for Diesel Registered Vehicles

Fig. 2. **Gasoline and Diesel Demand Shown as a Base and Aggressive (Dieselization) Scenario with an Estimated GTL Displacement**



Bottom Line

Base Case (million gallons/year) **IEPR Based**

Year	Gasoline Demand	Diesel Demand	Total	GTL Demand	LDD net Displacement	Aggregrated Gasoline and Diesel Reduction	Percent of 2020 Aggregrated Gasoline and Diesel Demand
2010	17,139	3,579	20,718	40	0	40	0%
2015	18,204	3,875	22,079	200	0	200	1%
2020	19,519	4,173	23,692	400	0	400	2%

Aggressive Case (million gallons/year)

2010	17,139	3,579	20,718	40	0	40	0%
2015	16,238	4,878	21,117	440	1,000	1,440	7%
2020	15,283	6,335	21,618	2,000	2,100	4,100	19%

Top Ten Impediments and Key Actions Needed

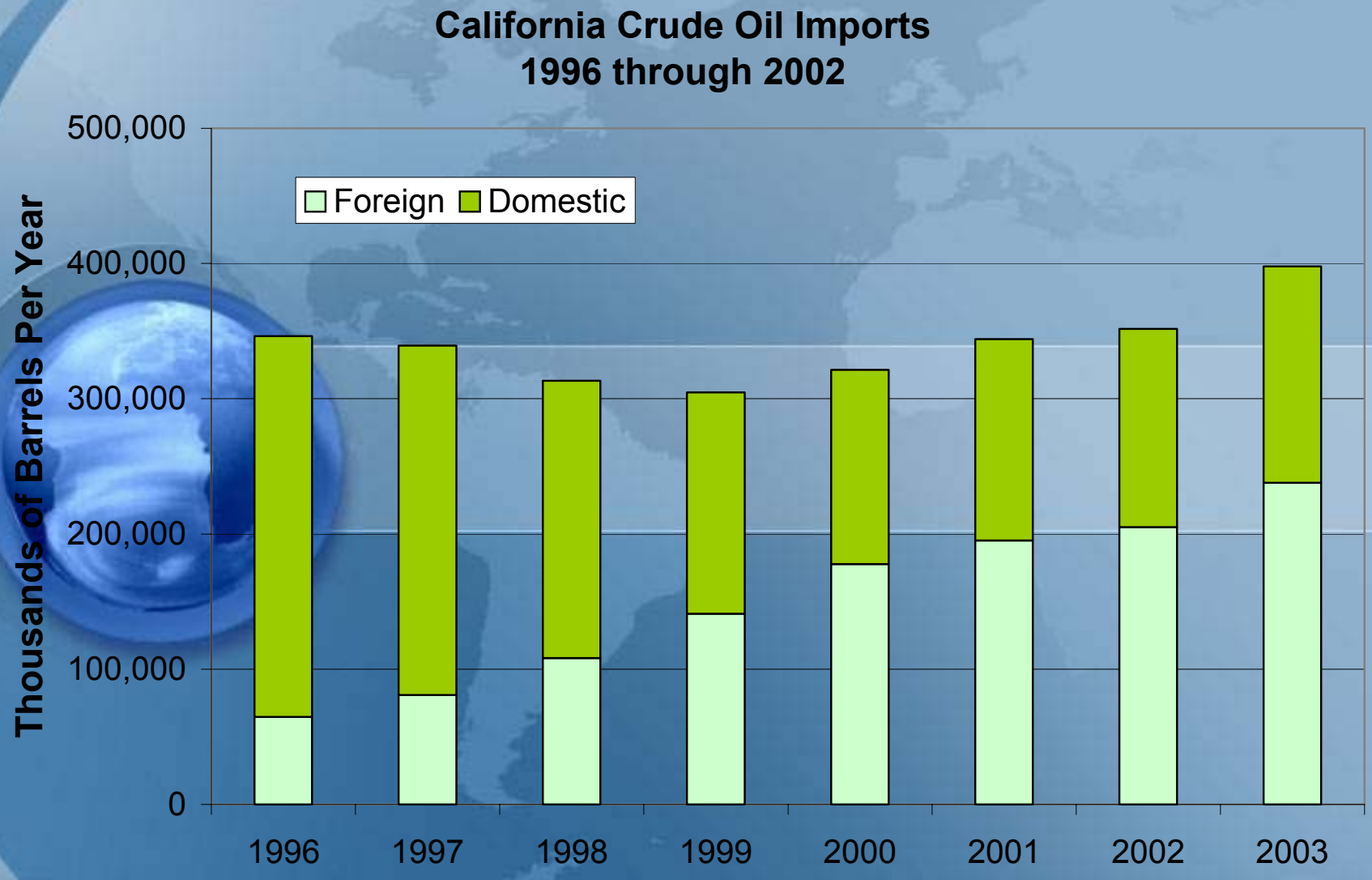
Objective: Prioritization of key actions that Industry and/or Government can take to address impediments to FTD use in CA.

#		**Survey results: 10/5/04 meeting sorted in ascending order of preference**
1		Perform a GTL marketing study (quantifying; California's markets pull, refining blending opportunities & refinery economics with GTL)
2		Expand GTL availability
3		Ensure that GTL meets ASTM D975 fuel specifications
4		Quantify if water born logistics to CA pose limitations to GTL
5		Establish GTL Fleet Demonstrations / increased GTL visibility
6		Establish a mechanism to add value to GTL blends that provides environmental or energy security value
7		Secure OEMs endorsement that GTL fuels are compatible with new and existing engines.
?		Light Duty Diesels are needed to generate GTL-friendly market conditions
?		State Mandate for Renewable Fuels (Restricted to renewable sources only i.e., BTL)
?		State Mandate for Alternative Fuels (GTL is considered an alternative fuel - regardless of origin)

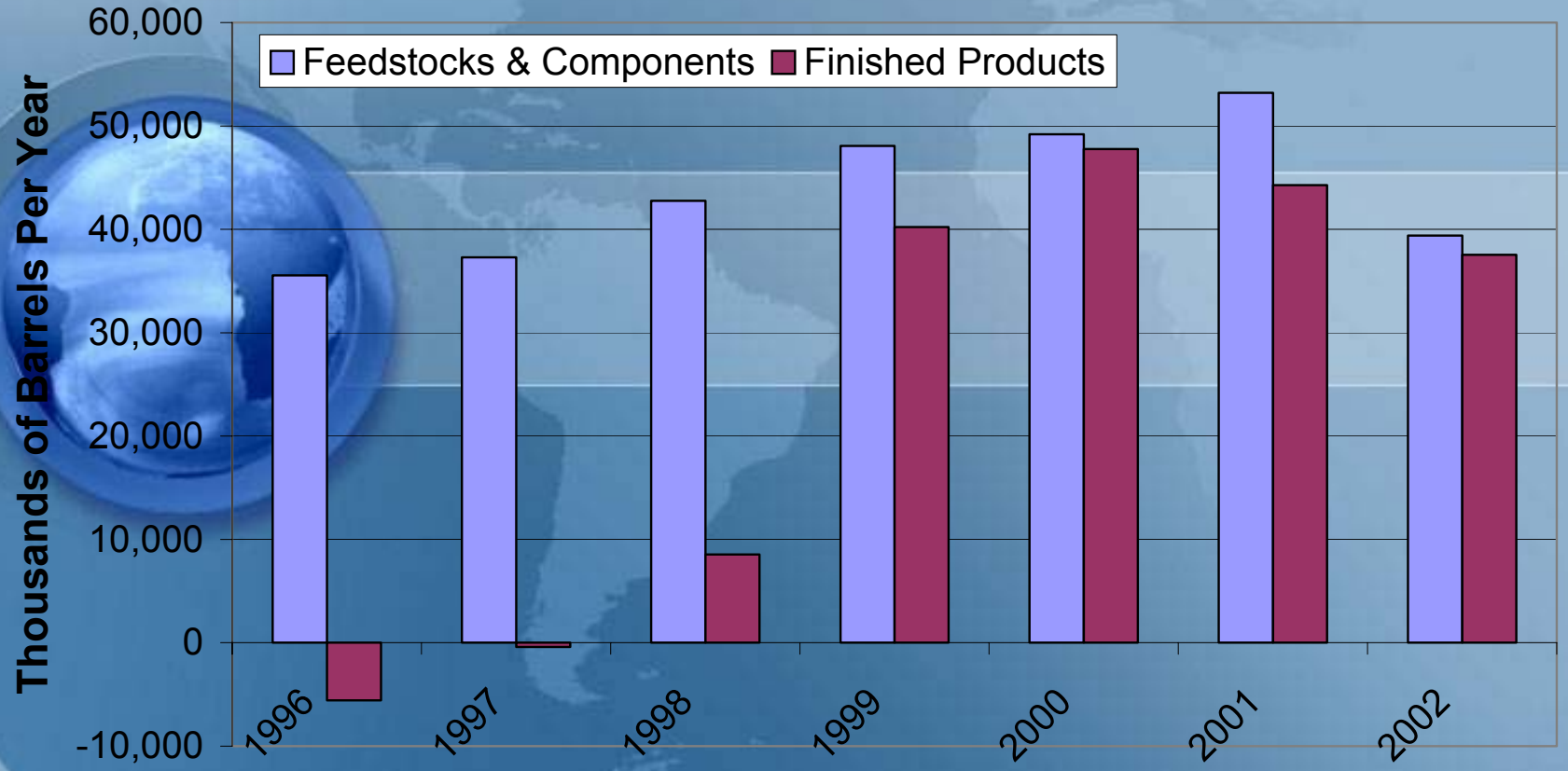
Vote Legend: 1=highest priority, 10=Lowest priority, R=reject this option

THE END

Any Questions?


California Crude Oil Imports
1996 through 2002
Thousands of Barrels Per Year
500,000
400,000
300,000
200,000
100,000
0
Foreign
Domestic
1996
1997
1998
1999
2000
2001
2002
2003

California Petroleum Net Imports
Refinery Feedstocks, Blending Components and Finished Products (Excludes Crude Oil)
1996 through 2002



Crude Oil Sources For California Refineries 1982 - 2003